

WHAT IS CLAIMED IS:

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1. A plasma processing apparatus for applying a plasma process to an object to be processed, the plasma processing apparatus comprising:

10 a process chamber in which the object to be processed is subjected to the plasma process;
a gas-introducing part connected to said process chamber so as to introduce a reactant gas into said process chamber;

15 a first vacuum pump connected to said process chamber so as to evacuate gas from said process chamber so that said process chamber is maintained at a negative pressure; and

20 a gas-evacuating arrangement connected to said gas-introducing part so as to evacuate the reactant gas from said gas-introducing part.

25 2. The plasma processing apparatus as claimed in claim 1, wherein said gas-evacuating arrangement comprises a second vacuum pump connected to said gas-introducing part.

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3. The plasma processing apparatus as claimed
in claim 1, wherein said gas-evacuating arrangement
comprises a bypass passage which connects said gas-
introducing part to said first vacuum pump by bypassing
5 said process chamber.

10 4. The plasma processing apparatus as claimed
in claim 1, wherein said gas-introducing part has an
annular shape and is incorporated into a sidewall of said
process chamber, said gas-introducing part has a plurality
of circumferentially arranged nozzles through which the
15 reactant gas is introduced into said process chamber.

20 5. The plasma processing apparatus as claimed
in claim 4, wherein said gas-introducing part comprises:
at least one inlet port from which the reactant
gas is supplied;
an annular gas passage connected to said inlet
25 port so that the reactant gas supplied from the inlet port
is supplied to said plurality of nozzles by flowing
through said annular gas passage; and
an outlet port provided to said annular gas
passage so that said gas-evacuating arrangement is
30 connected thereto.

6. The plasma processing apparatus as claimed
in claim 1, wherein said gas-introducing part comprises a
dielectric plate and a shower plate provided on a top of
said process chamber so as to introduce the reactant gas
5 from the top of said process chamber, a gas passage being
formed between said dielectric plate and said shower plate
so that the reactant gas flows through the gas passage and
is introduced into said process chamber through said
shower plate.

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7. The plasma processing apparatus as claimed
15 in claim 6, wherein dielectric plate has an inlet port
connected to said gas passage so as to supply the reactant
gas to said gas passage, and said gas passage has an
outlet port to which said gas-evacuating arrangement is
connected.

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8. The plasma processing apparatus as claimed
25 in claim 1, further comprising a slot antenna having a
plurality of slits so as to guide a microwave having a
predetermined frequency which is determined by the plasma
process to be applied to the object to be processed.

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9. The plasma processing apparatus as claimed in claim 8, wherein a density of the slits is substantially uniform in a radial direction of said slot antenna.

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10. A gas supply ring adapted to introduce a reactant gas into a process chamber of a processing apparatus, the gas supply ring comprising:

a plurality of circumferentially arranged nozzles through which the reactant gas is introduced into said process chamber;

15 at least one inlet port from which the reactant gas is supplied;

an annular gas passage connected to said inlet port so that the reactant gas supplied from the inlet port is supplied to said plurality of nozzles by flowing
20 through said annular gas passage; and

an outlet port provided to said annular gas passage so that the reactant gas is evacuated from said gas supply ring through said outlet port.

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11. A dielectric plate adapted to be attached to a process chamber of a plasma processing apparatus, the
30 dielectric plate comprising:

a plurality of nozzles through which a reactant gas is introduced into said process chamber;

at least one inlet port from which the reactant

gas is supplied;

a gas passage connected to said inlet port so
that the reactant gas supplied from the inlet port is
supplied to said plurality of nozzles by flowing through
5 said gas passage; and

an outlet port provided to said gas passage so
that the reactant gas is evacuated from said gas passage
through said outlet port.

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12. A plasma processing method comprising the
steps of:

15 evacuating gas from a process chamber by a first
vacuum pump connected to said process chamber;

introducing a reactant gas into said process
chamber through a gas-introducing part;

20 applying a plasma process to an object placed in
said process chamber by generating plasma from the
reactant gas;

stopping the introduction of the reactant gas
into said process chamber after ending the plasma process;
and

25 evacuating the reactant gas remaining in said
gas-introducing part by a second vacuum pump connected to
said gas-introducing part.

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13. A plasma processing method comprising the
steps of:

evacuating gas from a process chamber by a vacuum pump connected to said process chamber;

introducing a reactant gas into said process chamber through a gas-introducing part having a plurality
5 of nozzles;

applying a plasma process to an object placed in said process chamber by generating plasma from the reactant gas;

stopping the introduction of the reactant gas
10 into said process chamber after ending the plasma process;
and

evacuating the reactant gas remaining in said gas-introducing part by said vacuum pump by connecting
said gas-introducing part to said vacuum pump by bypassing
15 said process chamber.

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